

# **NASA Dryden Status**

**Aerospace Control & Guidance Sub-committee  
Meeting 105  
Lake Tahoe, NV  
March 2010**

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# IRAC F-18 #853 Testbed

- ! Dedicated Ghz processor for experiment

- ! Shell & process for Simulink autocode (or c-code)

- ! Can control commands to:

  - All aero surfaces (except speed brake)

  - All pilot inputs

  - Both engine throttles independently

- ! Limit checks done by Class A software in RFCS

- ! Potential for Class A experiment (dual ARTS IV or in quad RFCS) – take to landing?

- ! Tons of research instrumentation parameters (mostly related to structures)

- ! Simulated A-Matrix and B-Matrix failures



NASA Dryden Flight Research Center Photo Collection

<http://www.dfrc.nasa.gov/Gallery/Photo/index.html>

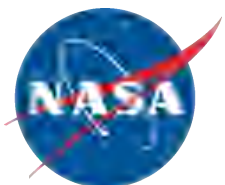
NASA Photo: EC04-0361-16 Date: December 15, 2004 Photo By: Carla Thomas

NASA's flexible-wing F/A-18 maneuvers through a test point during the second phase of the NASA/Air Force Active Aeroelastic Wing flight research program.



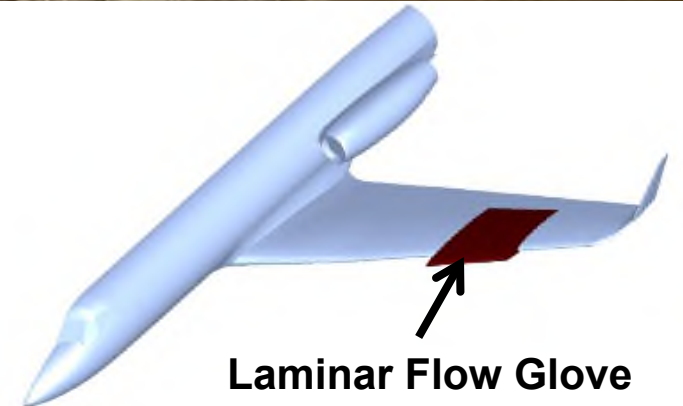
# IRAC F-18 #853 Testbed - Current Status

- ! Completed Hardware-in-the-loop testing (August)
  - ! First flight of new hardware – March 2010 – ON SCHEDULE
  - ! Dynamic Inverse controller – June 2010
  - ! Simplified Model Ref Adaptive Control – August 2010
- ! Evaluating simplified adaptive control approaches
  - ! Dynamic Inversion Baseline
  - ! Simplified MRAC
  - ! Benefit vs. complexity trade studies on extensions to basic MRAC
  - ! Interaction between adaptive controller and aircraft structure
- ! Investigating ways for pilot to control learning rates
- ! Planning to fly cross-coupling handling qualities metric development test with AFFTC test pilot school
- ! Future planned work
  - ! Adaptive controller implemented in redundant system



# NASA G-III Research Aircraft

- ! NASA DFRC is acquiring a Gulfstream III (G-III) to serve as a flying testbed for aeronautics experiments
- ! The aircraft will be instrumented and modified to accommodate a range of flight test-experiments
- ! Laminar Flow Glove
  - ! NASA's ERA program is funding a flight-test of a wing glove with a natural laminar airflow airfoil. Discrete Roughness Elements (DRE)s will be placed on the glove for passive laminar flow control. Texas A&M and Dryden will be developing the glove.
- ! Adaptive Compliant Trailing Edge (ACTE)
  - ! AFRL is funding development and flight test of an adaptive, compliant flap. The port inboard flap of the G-III will be replaced with a compliant design. The flight test will examine ACTE suitability as a lift control device (flap), control surface (ailerons), and trim device (trim tabs).
- ! Aircraft acquisition planned for early CY 2010.



# X-48 Blended Wing Body

- ! 74 flights completed on X-48B
  - ! Slats extended and slats retracted stall onset has been characterized
  - ! Flight results providing data for aerodynamic model and simulation updates
  - ! Currently flight testing departure limiter assault
- ! Peak seeking control to optimize in-flight drag reduction in 2010



- ! X48C completed wing tunnel testing
- ! Preparation work on X-48C for flight
  - FEM, simulation, engine integration, and control law development
  - Design and build flight weight parts
  - Complete modifications and prepare for flight



# SOFIA

- ! **Stratospheric Observatory For Infrared Astronomy**
  - ! 2.5 m diameter German built infrared telescope
  - ! Open port cavity
    - »! ~24°-57° viewable elevation range
  - ! Platform is Boeing 747 SP
    - »! Capable of 6+ hours of observation time
- ! **On going open door envelope expansion flights through 2010**
  - ! Concurrent with mission system build up and limited science missions
  - ! Completed two open door straight and level flights at 10% and 100% open in December 2009
  - ! Completed two expansion flights at 10% and 40% open up to 15Kft and 225 kias January 2010



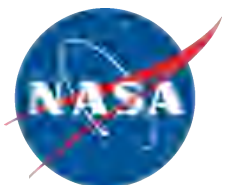
- ! Completed one shortened 70% open expansion flight February 2010
- ! Envelope clearance with a cavity acoustics focus
  - »! All test points show sound pressure levels are below expected levels thus far
- ! Autopilot interface development to support science mission navigation requirements is ongoing





# Orion CEV Launch Abort Systems Tests

- ! **Dryden is leading the test activities for the Launch abort systems test. Tests will be conducted at White Sands, NM**
  - ! **Pad Abort 1 (PA-1): Tests the basic functionality of the launch abort system from the pad in its preliminary design configuration.**
    - »! **Current launch date is late April – early May 2010**
  - ! **Ascent Abort 2 (AA-2): Tests the ability of the launch abort system to function as the spacecraft approaches the region of maximum drag.**
- ! **Current program status is to continue with the abort flight tests as planned through Sept 2010 (PA-1)**
- ! **AA-2 is also still currently in the plans as a technology demonstration**
- ! **Plans in work for everything after PA-1 test**
- ! **Current activities**
  - ! **Hardware testing and integration of the PA-1 crew module at White Sands, NM**
  - ! **Preparation for Flight Test Readiness Review**
  - ! **Planning for future flight tests (eg. AA-2)**



# To Fly What Others Imagine ...!